V. Operations and Facilities

A. DSN Operations

1. Network Allocation Schedules, *D. G. Tustin*

a. Introduction. The Network Allocation Schedules are a part of the DSN Operations and Analysis function, and are the means by which all operational activities of the Deep Space Network are committed and scheduled.

The need for a means of scheduling the network at varying levels of detail and time became apparent several years ago. With the scheduling methods then in use, it was not possible to commit support and schedule activities more than several weeks in advance. Under these conditions it was impossible to size the network and/or user's requirements far enough in advance for proper replanning of support or activities when a conflict occurred. The Network Allocation Schedules described in this article have been instrumental toward solving this problem.

b. Function. The Network Allocation Schedules provide the means of sizing the network and committing its resources to the various users. These commitments are made far enough in advance, and iterated enough times, to allow for adjustment in the resources (i.e., staffing) and/or changes in the user's basic project design, thus compensating for any period when the requirements exceed the base resources. Under this system, when the time of the planned activity is reached, the resources necessary for adequate support are available with no need to make last minute changes in plans, nor is there a large quantity of unused resources remaining idle.

c. Elements. The Network Allocation Schedules consist of four levels of schedules involving ever-increasing detail regarding time and equipment required, and covering ever-decreasing periods of time. In addition, provisions exist to change any of the levels as required and these changed data are recorded, creating a file of historical data.

The levels of schedules are (1) the 130-Week Network Loading Schedule, (2) the 72-Week Network Allocation Schedule, (3) the 8-Week Operations Planning Schedule, and (4) the 7-Day Operations Schedule; their relationship as to detail, vis-a-vis time period covered, is shown in Fig. 1.

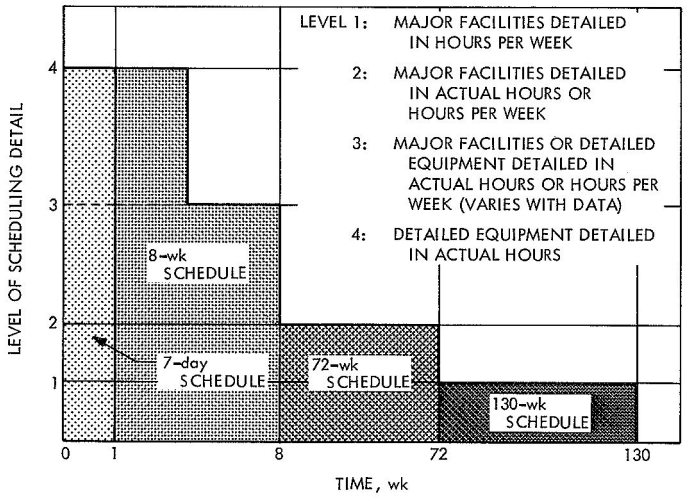

Fig. 1. Comparison of level of scheduling detail to time

d. Schedule operations. The interrelationship of the schedules and the general purpose of each can best be shown by beginning with the 130-week schedule and progressing to the 7-day schedule.

As each schedule is generated and published, it becomes the base from which the next schedule is constructed. Herein lies the key to the system. Once the requirements and resources have been sized, they are carried from one schedule to the next, requiring only some small adjustment as the detail increases.

The 130-Week Network Loading Schedule deals only with major resources (i.e., antennas, major computers, etc.) in hours per week per user, or tracks per week per user, in the case of the antennas. (When the tracks per week figure is used, it is assumed that a track equals 12 h of data acquisition or testing and includes any necessary pre- and post-track setup and calibration time.) The track allocation is based upon spacecraft view periods (trajectories), either actuals or nominals, thus avoiding a major conflict in a near-time period. With the requirements known, the staffing can now be adjusted and/or the requirements negotiated until a workable schedule is reached. This schedule is published as a part of the DSN support commitment for each project, thus allowing the project to make any necessary changes in plans well in advance of the requirement.

The above schedule, when published, becomes the basis for the 72-Week Network Allocation Schedule. This schedule expands the tracks and any other time-sensitive item to the actual day and time, and continues to carry the other items as hours per week. The level of detail for the equipment remains at major resources although a user may input a detailed equipment configuration for use in the later schedule if it is known. This schedule, when published quarterly, becomes a more detailed commitment to the network users, and is a direct input to the next level of scheduling.

The 8-Week Operations Planning Schedule takes its inputs directly from the 72-wk schedule and expands them to the maximum time and equipment configuration detail available. All activities that are missing this detail are flagged and the network users are given 3 wk to complete their planning and submit their detailed requirements. The 8-wk schedule is then published a second time showing all activities with the maximum detail as required for actual network operations. Any activities that are still deficient in detailed information are dropped from the schedule.

Every 7 days, a week is removed from the latest 8-wk schedule, updated with any last minute changes, and published as the 7-Day Operations Schedule. This schedule is used by the first level operational personnel to configure and operate the network in support of the users.

Throughout this process, changes in requirements and resources occur. When these changes are implemented into the schedules, they are also recorded in a history data bank. This data bank can then be used to determine network utilization, user planning ability, and many other items useful to management for planning and budgetary purposes.

e. Conclusion. The Network Allocation Schedules represent a large step forward for the DSN in resource management, resource commitment, and scheduling. Although the system is still growing, with new uses devised and requirements levied, it has already proven its worth both in long-range planning and near-real-time support by identifying major problems far enough in advance to allow for orderly solution and implementation. These schedules are currently being used as a model by another tracking network for the upgrading of their scheduling system.

B. SFOF Operations

1. SFOF *Mariner* Mars 1971 Mission Support Area,

B. M. Hayes

The *Mariner* Mars 1971 Mission Support Area in the SFOF has been functionally specified and the configuration determined (Fig. 2). The architectural and electrical designs for wall modifications and for the electrical power distribution system within the Mission Support Area have been completed.

To meet the required occupancy date requested by the *Mariner* Mars 1971 Project, a well-defined implementation schedule was developed. This schedule took into consideration the necessary approval cycles, installation of the new IBM 360-75 data systems (known as Mark III A), and facility construction. Before any of these events could occur, several other events that had an impact on these had to be resolved and performed. These events were: the relocation of the Flight Path Orbital Display Board, the relocation and combining of the *Mariner* Mars 1969 Extended Operations Mission and the *Pioneer VI* through *IX* Mission Support Areas, and providing an interim area for the checkout of the IBM 360-75 data system devices.

The schedule reflected the start of construction on June 10, 1970, with occupancy by the *Mariner* Mars 1971 Project on January 1, 1971. All of the construction, equipment installation, development testing, and systems checkout must be accomplished between these dates.

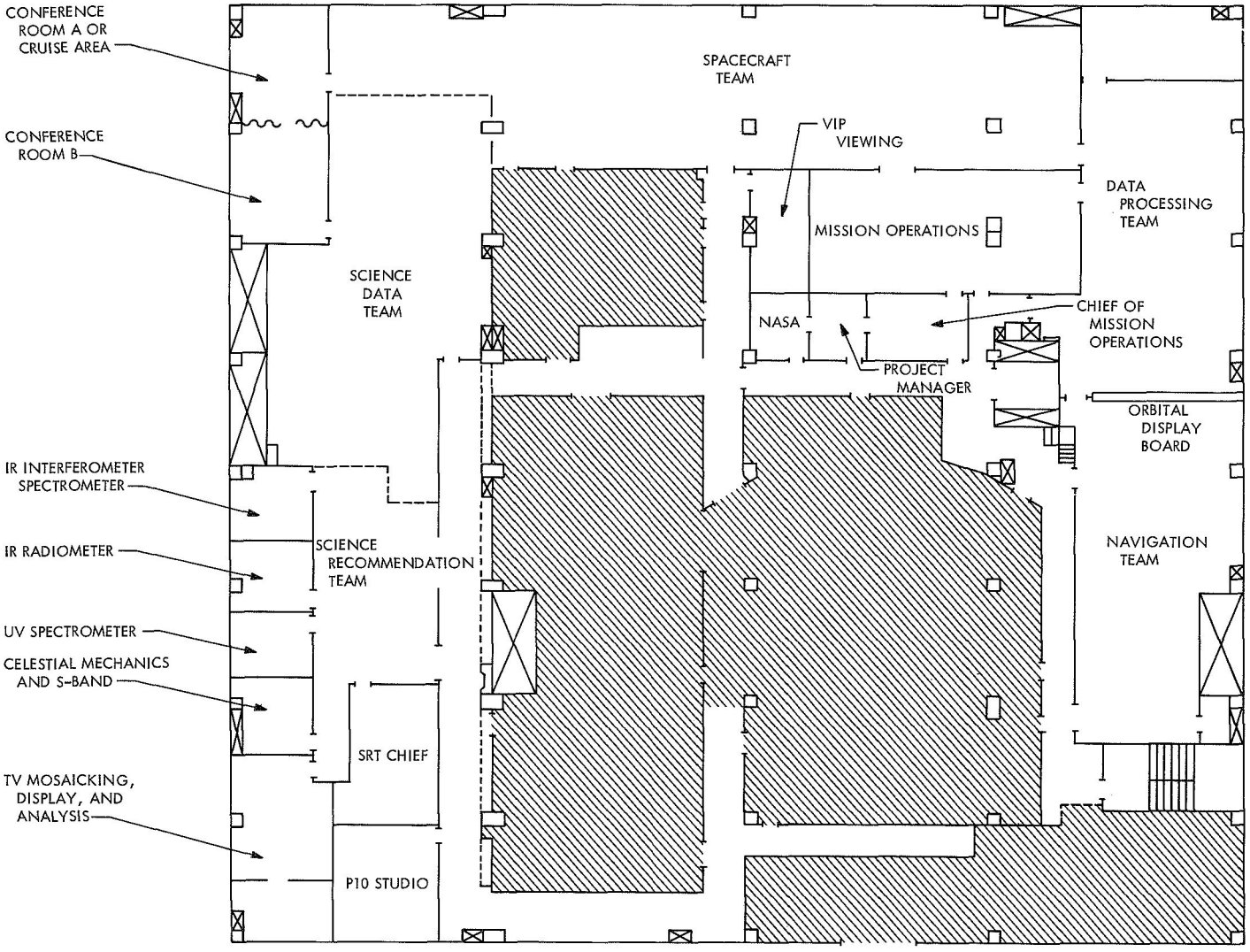

Fig. 2. *Mariner* Mars 1971 Mission Support Area

The *Mariner* Mars 1971 Project was asked to provide early inputs reflecting the types and numbers of IBM 360-75 devices required, and to define a Mission Support Area floor plan based on the requirements specified in the NASA Support Instrumentation Requirements Document. Certain constraints were placed on the *Mariner* Mars 1971 Project which were used as a guide in this planning. These were in the areas of building code, safety, equipment access, personnel access, cable runs, electrical power, communications, acoustics, and lighting.

The *Mariner* Mars 1971 mission operations area contains the following distinct sub-areas: Navigation Team, Data Processing Team, Spacecraft Team, Mission Operations, Science Data Team, Science Recommendation Team (SRT), Cruise, and the Public Information Office (PIO) studio. Additional space is also defined in these areas for a conference room, VIP viewing, NASA, Project Manager, and the Chief of Mission Operations. This Mission Support Area utilizes 13,600 ft^2 of space in the SFOF. The physical arrangement of the mission operations and analysis areas is based upon previous *Mariner* project operations and the utilization of the new Mark III A data systems. The Mission Operations room, Data Processing Team room, Navigation Team room, Spacecraft Team room, and Science areas have been located to provide a maximum degree of interaction and communication. Emphasis was placed on the maximum utilization of glass in all areas to provide the desired visual communication between these areas. The Mission Operations room will again feature one of the round six-man conference consoles used very successfully for the previous *Mariner*, *Surveyor*, and *Pioneer* mission operations. The Project Manager and Chief of Mission Operations are positioned so that they can observe all operations when necessary, but can remain separated from the operations when desired. A viewing room will permit visitors a direct view of Mission Operations and the Spacecraft Team areas from outside of these immediate areas. The Spacecraft Team room utilizes consoles for the two spacecraft team leaders and spacecraft team chief. Desks and tables have been provided for the 28 analysts. The Navigation Team room remains unchanged from previous missions with the exception of the Flight Path Orbital Display Board, which has been relocated to provide better visibility to personnel of the Navigation Team. The Science Data and Science Recommendation Team rooms provide individual, distinct rooms for the various science experimenters. Analysts and experimenters in all of the individual team areas will be provided with desks and tables.

A PIO studio is being designed for utilization during orbital operations. This PIO studio will be similar to the one used by the experimenters during the *Mariner* Mars 1969 encounter operations. An operations console will be provided which contains a switching capability to provide real-time television output to commercial television and other portions of the Laboratory. Experience gained during the *Mariner* Mars 1969 encounter operations dictated that early planning was necessary in order to eliminate the last minute problems that occurred. Emphasis will be placed on an increased working space at the console, the utilization of the special effects generator, and hard copy camera location and lighting. The room has also been designed for optimum acoustics which was a major problem during the *Mariner* Mars 1969 encounter operations.

Communications within the entire *Mariner* Mars 1971 Mission Support Area will be accomplished through the use of the voice communications network and closed circuit television. The closed circuit television will be utilized for the dissemination of digital formatted data from the IBM 360-75, time display, updated sequence of events information, as well as display of many individual elements of teletype information.